Research and Development Broad Agency Announcement

Multiple Link Antenna System

(MLAS)

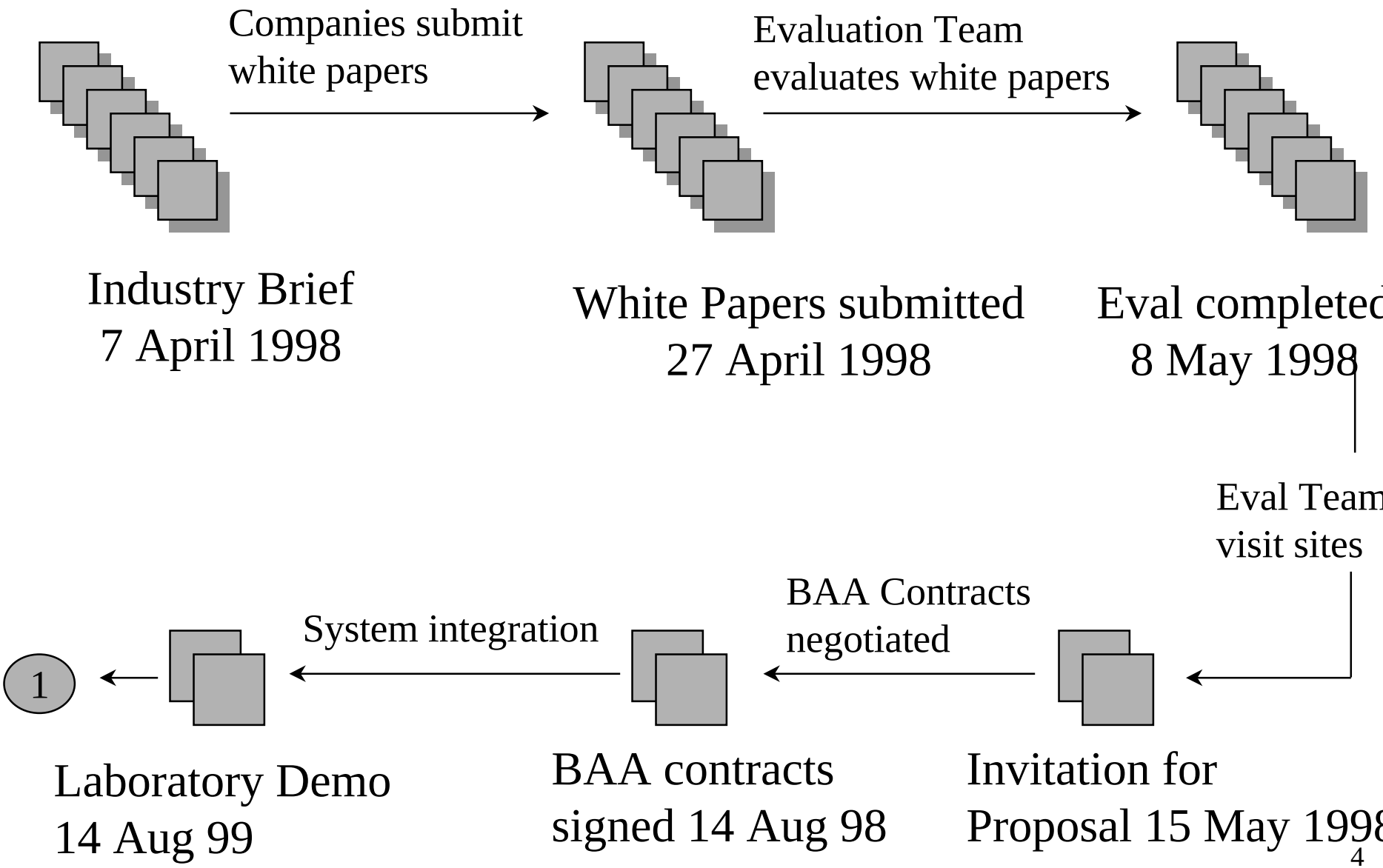
Brief Outline

- Purpose of BAA
- Schedule
- MLAS technical parameters
- White papers
  - Format
  - Evaluation Criteria

Purpose

- To solicit research and development “white papers” to exploit existing antenna technology for integration into a Tactical Control System. Papers that present an acceptable approach will be selected for further consideration by invitation to submit a formal, in depth, unclassified proposal. There will be one or more awards.

MLAS BAA Process



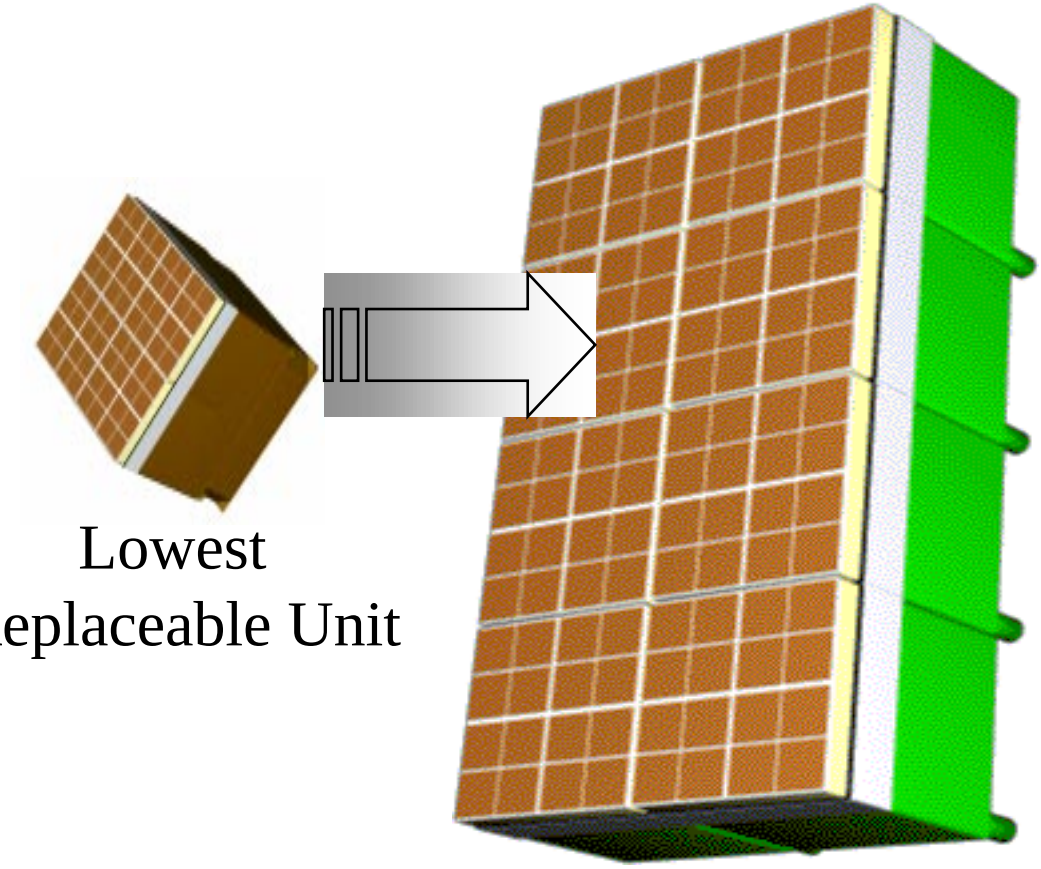
MLAS antenna Requirements

- The MLAS antenna shall allow TCS to simultaneously communicate with at least two air vehicles via a single antenna aperture.
  - **simultaneous** operation indicates that both communications links shall operate full duplex **at the same time** without degradation of either communication link's BER (both up and down link) due to the other link.
- MLAS antenna shall be electronically stabilized and steered (to reduce weight and maintenance associated with mechanically steered antenna pedestals).
- Be Deployable on ships, land vehicles and aircraft

MLAS antenna Requirements

- A single MLAS aperture shall cover a minimum 90^{o} (Az and El) quadrant while meeting all other requirements.
- The MLAS shall minimize impact to the radar cross-section of the ship/land/air vehicle (i.e., be designed for conformal installation)
- Operate with Common Data Link Compatible data links.

MODULAR ANTENNA CONCEPT

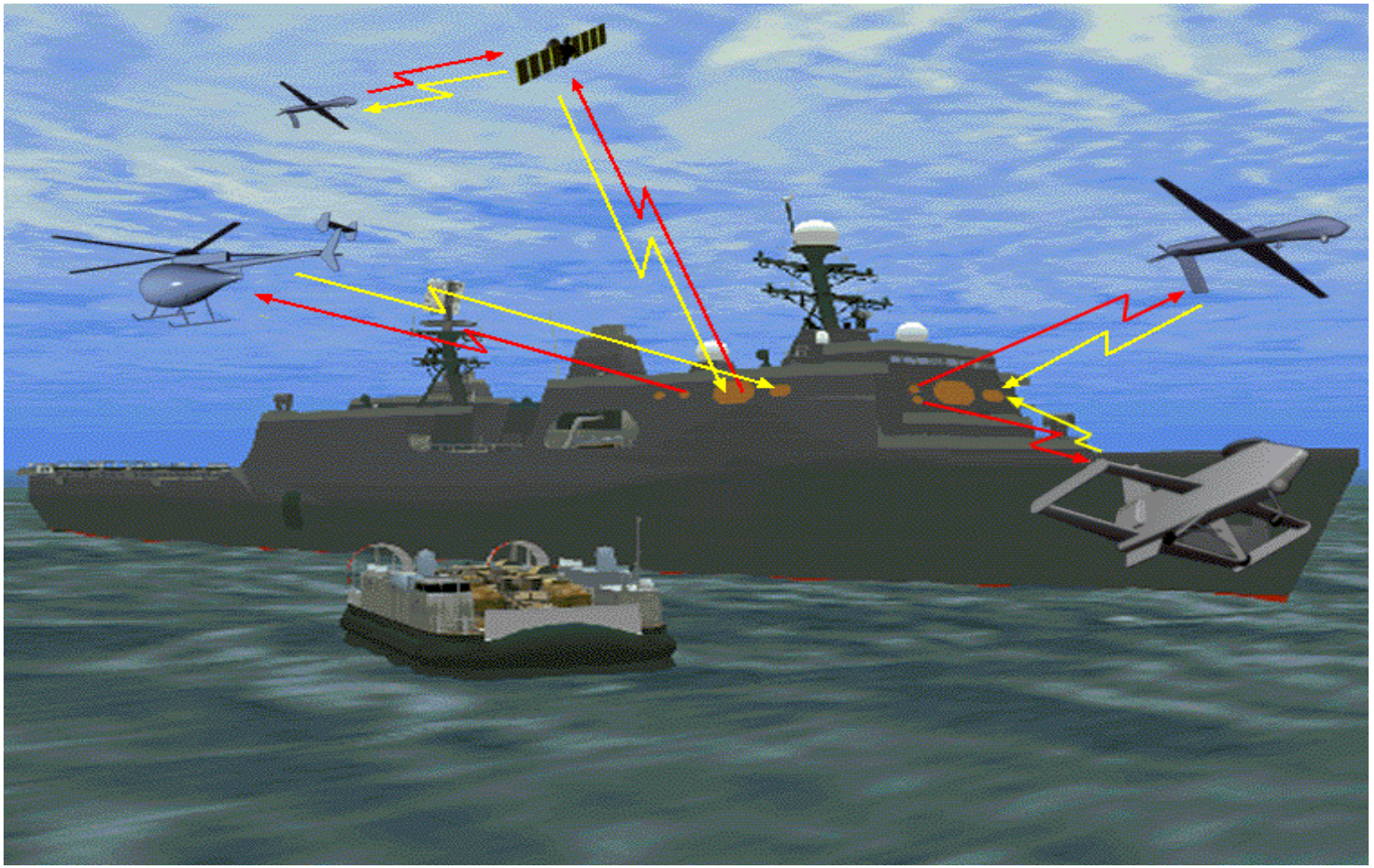


Lowest
Replaceable Unit

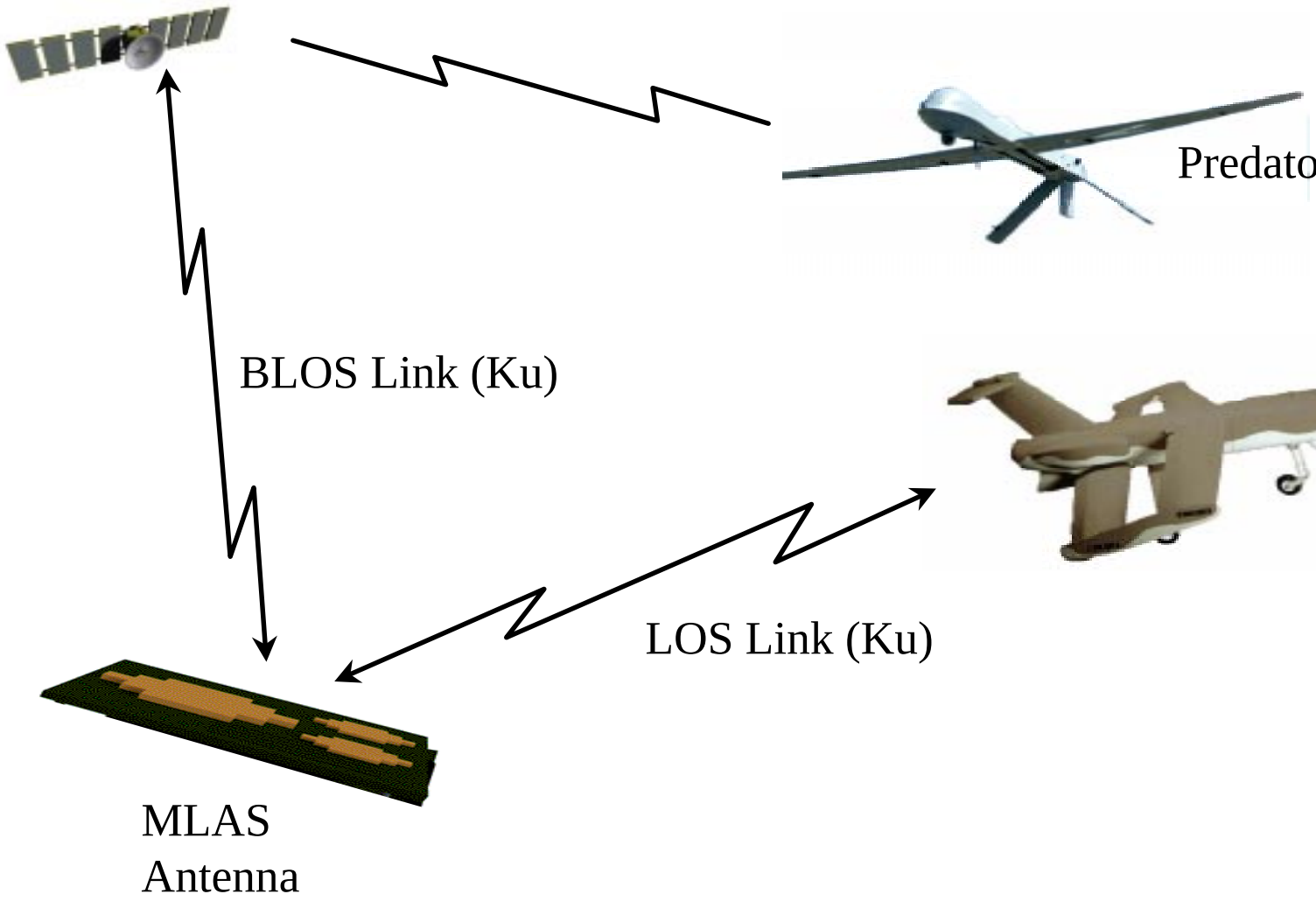
ANTENNA

MLAS LRU contains radiating elements and passive and active RF components required to “close” the supported data links

Operational Relevance



Demo Configuration



Demo *Line of Site* Link

- Common Data Link (CDL) compatible
  - MLAS Demonstration array shall be fully compliant with the CDL system specification
    - Command Link data rate - Supports 200 kbps data rate
    - Return link data rate - Supports 10.71, 137.088 and 274.176 Mbps data rates
    - Ku-band only - Tunable over 14.4 to 15.35 GHz freq range
    - Modulation - as specified in CDL specification

Demo *Line of Site* Link

(continued)

- **Link Budget calculations**:
  - Slant Range - 200 km(15000 foot altitude, no obstructions, clear weather)
  - Assume 10 dB link margin required
  - Assume 8 inch Ku-band airborne antenna with 10W PA
  - BER - Link required to maintain average BER of $1*10^{-6}$ or better (after error correction and using data encryption)
  - Relevant documentation - Common Data Link Segment Class 1 Specification

Demo *Beyond Line-of-site* Link

- **Transmit Link:** (Gnd to Air)
  - 64 kbps data rate, SSQPSK spread to 8.192 Mchip/sec
  - 14.0 to 14.5 GHz RF frequency range
  - Polarization - Linear

- **Predator Air Data Terminal Parameters**
- 30” Aperture
- G/T - 12.5 dB/K
- ADT Receiver Eb/No = 5.8 dB (BER $<10^{-6)}$

Demo *Beyond Line-of-site* Link
(Continued)

- **Return link**: (Air to Gnd)
  - 1.544 Mbps
  - 10.95 to 12.75 GHz RF frequency range
  - O-QPSK
  - FEC (concatenated RS(247,231))

- **Predator Ground Data Terminal Parameters**
  - Size - TBD by BAA contractor
  - G/T - 25dB/K (IESS-208 for EI)
  - SDT Receiver Eb/No = 5.8 dB (BER $<10^{-6)}$

- **Demo array shall meet Intelsat Standard E-1 earth terminal requirements of IESS-208**

Demo *Beyond Line-of-site* Link
(Continued)

- For initial link budget (antenna sizing) calculations use:
  - Satellite - Intelsat 7 Series at 342ºE
  - ADT @ -20ºW, +45ºN
  - GDT @ -20ºW, +42ºN
  - rain margin = 2.5 dB
  - System Performance margin >= 2.9 dB

White Papers

White Paper Format

- Section A:
  - Title of Paper
  - Pricing Information
    - Estimated price for lab demo
    - NTE’s for options
    - Proposed cost-sharing arrangements (if applicable)

White Paper Format

- Section B:
  - Description of current antenna module
    - Evolution of module
    - Functional architecture
    - Current Capabilities/future plans
    - Documentation available
    - Operational users (include POCs)
  - Compatibility with DoD multi-data link environment

White Paper Format

- Section C
  - Organizational and Management Approach

White Paper
Evaluation Criteria

- Technical Merit
  - Approach to supporting multiple data links
    - Requirement - support 2 data links simultaneously
    - Objective - support more than 2 data links simultaneously
  - Potential to support multiple service applications/installations
    - Rugged
    - Conformal
    - Modular
  - Beam steering speed

White Paper
Evaluation Criteria

- Size, Weight and Power estimates for demo configuration
- Producibility (Automated)
  - Amplify producibility percentage and identify shortfalls

MLAS Information

- MLAS information can be found on the TCS homepage:

  http://uav.nswc.navy.mil/tcs
- IESS-208 can be found on the Internet at:

  http://www.intelsat.int/engin/ces/iess/iess.htm
- CDL specification application forms are available today.

Questions

Questions with respect to R&D BAA for Antenna-with-Prototype Interface to Tactical Control System (TCS)

- #1 What are the Transmit and Receive Frequencies and Bandwidths? **See IESS 208 and CDL Spec.**
- #2 What are the Antenna Polarization requirements? **See IESS 208 and CDL Spec.**
- #3 What are the Antenna Gain requirements? **Determine from Link Budgets.**
- #4 What are the System EIRP & G/T requirements? **See Brief.**
- #5 Do the requirements for the lab demo and shipboard demo hardware differ? **No.**
- #6 Do the requirements for the Objective Production Systems differ from the demo hardware. Will objective systems require 360^{o} Azimuth coverage? **To be determined.**
- #7 Is it anticipated that the antenna function could, at a later date, be merged into another, yet to be developed, Antenna System? **No.**
- #8 What is meant by prototype-interface-system module? **Covered in the Technical Brief.**
- #9 What are the specific Antenna interface requirements? What other Ships-systems in addition to the TCS must the Antenna interface with? **This will be defined during the proposal development phase.**

Questions with respect to R&D BAA for Antenna-with-Prototype Interface to Tactical Control System (TCS) (Con't)

- #10 Must the Antenna support tracking of the UAV or is GPS used to maintain track? **GPS.**
- #11 How is the UAV initially acquired? **By LOS Antenna.**
- #12 What is the UAV Range & Altitude? **The antenna must support data links from UAV'S ranging from the High Altitude to LOS vehicles such as Outrider or Pioneer.**
- #13 How many UAVs will be handled at once? **At least two.**
- #14 Must the Antenna support simultaneous, CW, two-way? transmission with multiple UAVs? **The requirement is to support simultaneous full duplex data link communications with two or more UAV's.**
- #15 Can you explain the apparent contradiction between the following two statements in the BAA "to exploit existing antenna technology for integration into TCS systems" and "Proposals for concepts that have already been developed or proven are inappropriate for this BAA?" **Existing technology is defined in the Technical Brief. If a concept exists which will meet this requirement, we do not want to pay for it again.**